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Do bidders require a monetary premium for cognitive effort in an auction?

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ABSTRACT

Research on the influence of cognitive effort on decision making has grown in recent years. We argue that when cognitive effort is required, a decision maker requests a monetary premium for his effort. In our experiment, the participants were asked to bid a price for lotteries of differing complexity that required varying amounts of cognitive effort. Furthermore, some participants were given a simple calculator. We show that the increase in cognitive efforts increases the monetary premium they request, and leads to better pricing of similar lotteries.

1. Introduction

People want to make good decisions, either because they wish to appear accountable or because they want to maximize expected utility. The expected utility theory (Von Neumann and Morgensten, 1944) and the prospect theory (Kahneman and Tversky, 1979), note that the decision making process requires integrating likelihood (i.e., probability) and outcomes (good or bad). Nevertheless, research has shown that people do not always base their decisions on a cold or rational evaluation of utility (see Dowling, 1986; Lopes, 1987; Elster and Loewenstein, 1992; Rottenstreich and Christopher, 2002). Often they use different heuristics to decide.[2]

While making decisions people need to think, meaning they must invest cognitive effort which is basically the mental effort invested by the decision maker in the decision making process (Lee et al., 1994). Simon (1956, 1957) suggested that people often use a "satisfying" decision making strategy which also considers the costs of the decision making process itself, because they have limited cognitive resources. This strategy does not lead to optimal decisions. Simon (1956) wrote, "It appears probable that, however adaptive the behavior of organisms in learning and choice situations, this adaptiveness falls from short of the ideal of 'maximizing' postulated in economic theory. Evidently, organisms adapt well enough to satisfies; they do not, in general, optimize" (p. 129).

The literature describes two different mechanisms for making decisions with different levels of cognitive effort: a quicker mechanism that is emotional and intuitive (Hogarth, 2001; Myers, 2002) and a reflective mechanism that is activated more slowly (Kahneman, 2003; Loewenstein et al., 2001; Sloman, 2002; Sanfey and Chang, 2008). Both mechanisms are incorporated in dual-process models (Chaiken and Trope, 1999; Smith and DeCoster, 2000; Sloman, 2002). Stanovich and West (2000) refer to these mechanisms as "System 1" and "System 2." System 1 is characterizd as "automatic, largely unconscious, and relatively undemanding of computational capacity. Thus, it conjoins properties of automaticity and heuristic processing" (Stanovich and West, 2000, p. 658). System 2 represents controlled processing, and can be characterized as analytic intelligence processes that try "to uncover the computational components underlying intelligence" (Stanovich and West, 2000, p. 658). Smith and DeCoster (2000) review several dual-process models, and argue, "Heuristic processing is the default processing mode; people will process heuristically unless special circumstances intervene" (p. 119). They also argue that, among other reasons, people go beyond the heuristic processing to systematic processing "when circumstances make them feel an unusually great need to be accurate" (p. 119). However, using System 2 requires cognitive effort. Since humans have limited

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[1] http://www.colman.ac.il/english/Pages/default.aspx.

[2] Tversky and Kahneman (1974) originally identified three general purpose heuristics: availability, representativeness, and anchoring and adjustment. See also Kahneman and Frederick (2002).

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cognitive resources, they allocate them judiciously and expend only the effort necessary to make a satisfactory, rather than optimal, decision (Payne and John, 1982; Russo and Dosher, 1983).

The decision making mechanism and the cognitive effort depend, inter alia, on motivation and ability to think (for example: Eagly and Chaiken, 1993; Forgas, 1995, 2001; Kruglanski et al., 1999; Petty and Cacioppo, 1986). A possible motivational activator[3] is the "demand effect." According to the demand effect, the behavior of participants in experiments may be based on their understanding of how they are expected to behave. They may think that the experimenter expects them to behave in a particular way (Bardsley, 2005, 2008; Binmore et al., 1985; Lonnqvist et al., 2007; Milgram, 1963; Paulhus, 1991). According to Kelly et al. (2008): "Demand effects occur when participants have an expectation of how they should behave in a particular research setting" (p. 125).

In the current paper, we describe the effect of cognitive effort on the risk premium requested by participants. We argue that if cognitive effort is needed, a participant ought to ask for monetary premium in compensation for effort. We tested our argument experimentally by selling four lotteries, which had different levels of complexity, in random number auctions using the Becker–Degroot–Marschak method (BDM; Becker et al., 1964). We ran the auctions using two different treatments, and created different levels of cognitive effort, by giving the participants in one group a simple calculator ("*calculator group*"). In the *standard* treatment, participants were asked to bid with standard instructions and no calculator.

When comparing the average risk premium (the difference between the lottery's expected value and the bid) for each group, we found that the standard group requested a higher average risk premium for the complex lotteries than for the simple lotteries. However, in the calculator group the average risk premiums for the simple and the complex lotteries did not differ. These results indicate that the standard group invested a higher cognitive effort in the complex lotteries, while cognitive efforts used by the calculator group remained the same. We also found that the risk premiums for the complex lotteries were not significantly different in the two treatments. In the simple lotteries, participants in the calculator treatment showed lower average bids (higher risk premium) than participants in the standard group. We suggest that in complex lotteries the participants allocated cognitive effort whether or not they were affected by the demand effect (due to the calculator). Although the cognitive effort used in the simple lotteries is quite small, the demand effect (created by the calculator) forced the participants in the calculator group to invest cognitive effort. Therefore, they requested a monetary premium.

The rest of the paper organized as follows: in the next section, we present a model for the required premium and cognitive efforts. Then, we present the experiment and the results. In the last section, we summarize and conclude.

2. The model

When investors evaluate a risky asset, they usually look at its expected value and risk. When it is not simple to calculate the expected value, the decision maker will need to invest more complex thought than when the expected value calculation is simple. We argue that when a participant has a new task, he takes the task's complexity into consideration. If it is a simple task that requires a low cognitive effort, the participant may use only System 1 heuristics. When evaluating a risky asset, he asks for a low premium for his decision (bid: WTP1; WTP = willingness to pay). However, if the task is complex or there are other complicated requirements (for example, the demand effect), the participant will use System 2 and ask for a higher premium because of the effort (bid: WTP2). In an auction for a complex risky asset, a participant will request a risk premium, meaning he will make a lower bid[4] (WTP1 > WTP2) (Fig. 1).

[3] Another example for motivational activator is accountability, which is the need to justify behavior to others (e.g. Curley et al., 1986; Lerner and Tetlock, 1999; Tetlock, 1985; Tetlock and Kim, 1987; Warner and DeFleur, 1969).

3. The experiment

3.1. Sample

The experimental sample consisted of 86 second-year students of economics and management at the Open University in Israel (mean age = 28.3, 57% males). The experiment took place in classrooms. The experimenter offered the students the opportunity to participate in a decision-making experiment, with the chance of making some money. The experimenter informed the participants that they could also choose to not participate, and that the experiment was not part of the course, so their grade would not be affected. They were told that the results were for research purposes only.

3.2. Experimental design

We used the prepaid incentive mechanism (PPM) proposed by Rosenboim and Shavit (2012). As a preliminary step, two weeks prior to the actual experiment, an experimenter came to a regularly scheduled class and distributed NIS[5] 40 to each student. He informed them that the money that had been distributed to them would be used in an experiment, and that they would not be required to make any preparations prior to the actual start of the experiment, just bring the money. After two weeks, the experimenter returned to the class and asked participants to take part in the experiment. Since the experimenter came to their class there was no transaction cost[6] to the participants. In the PPM, participants are likely to see the initial payment as their own, and will make decisions as though they are using their own money with hardly any bias created by the "house money effect" (Thaler and Johnson, 1990).

Each questionnaire listed four different lottery tickets, each lottery on a different page. The order of the lotteries was randomized to avoid an order effect. For each lottery, the participants were asked to bid for buying the lottery (WTP) in a random price auctions using the BDM method (Becker et al., 1964)[7], in which a number between the minimum and the maximum outcomes of the lottery is randomly selected. If the participant's bid is above the random number, he wins the auction, pays the random number and participates in the lottery (receives the lottery's outcome). If the participant's bid is below the random number, he loses the auction, don't pay anything and keeps the initial endowment. In two of the lotteries (A and C), it was easy to calculate the expected values, but the other two (B and D) lotteries were considered "complex" because it was difficult to calculate their expected values. The four lotteries are presented in Table 1.

[4] The premium is usually measured as the difference between the risky asset's expected value or certainty equivalent and the WTP. This means that the premium increase with the decrease in WTP.

[5] New Israel Shekels. The exchange rate at the time of the experiment was NIS 3.5 to USD 1.

[6] Transaction cost was described by Coller et al. (2005) as the "extra cognitive effort involved in keeping track of the later payment date or to the extra physical effort involved in returning on the later date to receive the payment" (p. 2).

[7] BDM is used in many experimental studies eliciting WTP (e.g. Kahneman et al., 1990; Plott and Zeiler, 2005; Shogren et al., 2001).